The opinion in support of the decision being entered today was not written for publication and is not binding precedent of the Board.

Paper No. 24

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Ex parte CHIH-LUNG (BRUCE) LIN
and MING-CHIEH LEE

Appeal No. 2003-2082
Application 09/201,278[1]

ON BRIEF

Before HAIRSTON, BARRETT, and BARRY, Administrative Patent Judges.

BARRETT, Administrative Patent Judge.

DECISION ON APPEAL

This is a decision on appeal under 35 U.S.C. § 134(a) from the final rejection of claims 1, 3-13, and 15-22. Claims 2 and 14 have been canceled.

We reverse.

[1] Application for patent filed November 30, 1998, entitled "Efficient Motion Vector Coding for Video Compression."

BACKGROUND

The invention relates to coding and decoding motion vectors for video coding and decoding applications. To exploit statistical dependence between the x and y motion vector components, an encoder assigns a single variable length code (VLC) from a VLC table (referred to as a "codebook") to jointly represent the x and y components. Including VLCs in the VLC table for all possible pairs of x and y components can make the VLC table inefficiently large. So, the encoder uses training (e.g., by statistical analysis of example video sequences) to determine which pairs of x and y components are to be represented by VLCs from the VLC table, and which pairs are to be represented by an escape code plus non-VLC (e.g., literal) values. This statistical analysis to assign codes is described in the specification, page 10, lines 12-23.

Claim 1 is reproduced below.

> 1. In a video coder for coding video images in a block format, a method for improving compression of the video images comprising:
>
> predicting x and y motion vector components for a current block of pixels based on a motion vector of at least one neighboring block of pixels to compute x and y components of a predictor motion vector;
>
> computing differential x and y components from the x and y components of the predictor and x and y components of a motion vector for the current block; and
>
> assigning a single variable length code to joint x and y differential motion vector components, wherein the single variable length code is assigned from a variable

length code table, the table comprising a list of pairs of joint differential motion vector components and a corresponding variable length code for each pair, such that shorter variable length codes are assigned to joint differential motion vector components that have a higher probability of occurrence in the video images, and longer variable length codes are assigned to joint differential motion vector components that have a lower probability of occurrence, wherein the table includes the most probable pairs of joint differential motion vector components as computed by statistical analysis of example video sequences.

THE REFERENCE

The examiner relies on the following reference:

Guo Yao Yu and Cheng-Tie Chen (Yu), Two-Dimensional Motion Vector Coding for Low Bitrate Videophone Applications, Proceedings, International Conference on Image Processing, Vol. 2, pages 414-417, October 1995.

THE REJECTIONS

Claims 1, 3, 4, 7-9, 11-13, and 15-22 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Yu.

Claims 5, 6, and 10 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Yu.

We refer to the final rejection (Paper No. 11) and the examiner's answer (Paper No. 18) (pages referred to as "EA__") for a statement of the examiner's rejection, and to the brief (Paper No. 17) (pages referred to as "Br__") and reply brief (Paper No. 19) (pages referred to as "RBr__") for a statement of appellants' arguments thereagainst.

OPINION

The independent claims are all argued separately. The dependent claims are stated to stand or fall together with their respective independent claims (Br4).

We fully agree with appellants' description of Yu[2] (Br4-5) and with the arguments in the brief and the reply brief. The anticipation rejections of independent claims 1, 7, 11, 13, 16, 19, 20, and 23 are reversed for the reasons stated by appellants. The rejections of dependent claims 3-6, 8-10, 12, 15, 17, 18, and 21 are consequently also reversed. Nevertheless, we review the findings and relevant claim limitations for the examiner.

The support for the argued claim limitations is found in the specification at page 10, lines 14-23. We fully agree with and adopt the following findings by appellants (at RBr11):

- Yu's VLC table assumes, before training, that each and every pair of DMV x and y components in Region A is more likely to occur than any DMV pair in regions B or C.
- The number and identity of the DMV pair to be represented by VLCs in Yu's VLC table are not determined by training or statistical analysis.
- Yu describes, for *the pre-determined set of DMV pairs in Region A*, calculating VLCs based upon frequencies of occurrence in a training set of test sequences.

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[2] Yu was cited by appellants in an information disclosure statement (Paper No. 5). Independent claims 1, 7, 11, 13, 16, and 19 were amended by preliminary amendment A (Paper No. 6) to add the limitations now argued to distinguish over Yu.

- Yu uses training to determine the relative lengths of the VLCs in the VLC table, not to select the DMV pairs to be represented by VLCs in the VLC table.

The difference between Yu and the claimed invention is illustrated by appellants' Appendix B and Appendix C. The DMV pairs in Region A of Yu (Fig. 2, page 416), as shown in appellants' Appendix C, are represented by an entry in the VLC table and a sign bit (pages 415-416). Actually the pairs are represented by the absolute DMV values from 0 to 8.0 in 0.5-pel divisions (17x17=289 entries in the table, page 416, left col.) plus a sign bit (if every pair in Region A had to be represented by a separate entry in the code table there would be 1,089 entries). Yu assumes that DMV pairs in Region A (points shown in Appendix C) are the most probable DMV pairs without using any training or statistical analysis. Yu performs training to determine the length of the VLC to be assigned to an entry in the VLC table, where the entries in the VLC table correspond to the absolute value of DMV pairs in Region A (shown in Appendix C). By contrast, appellants' training runs identify the DMV components having the highest probability as shown in Appendix B and would determine which of these to include in the VLC table. Each of the DMV pairs would be assigned a VLC in the VLC table. Appellants correctly argue that "[a]lthough Yu may determine lengths of VLCs based on a training set, Yu does not use statistical analysis to determine which DMV pairs to include in

the VLC table" (RBr3). Therefore, appellants' invention uses statistical analysis (training) both to determine the most probable pairs of DMV components to include in the table and to determine which VLC to assign to the entries in the table, while Yu only discloses training to determine which VLC to assign to the predetermined entries in the table.

Claim 1 recites "wherein the table includes the most probable pairs of joint differential motion vector components as computed by statistical analysis of example video sequences." The examiner finds (EA4): "In Yu ... the 290 codes in the VLC table represent the 'possible' absolute DMV values ... which are determined through the training runs. In the example, the size of the VLC table depends on a finite number of training runs." However, the 290 entries in the VLC table are predetermined and correspond to the DMV pairs in Region A. The boundary of Region A is set and is not determined by training runs. We agree with appellants that "Yu describes using the training runs only to determine lengths of variable-length codes ('VLCs') for the DMV pairs of Region A in the VLC table" (RBr2).

The examiner further states (EA4): "Yu ... discloses that the 290 VLC codes are resulted from the training set of five test sequences. Later, Yu discloses ... that 'the VLC code table is obtained based on a finite number of video sequences' i.e., based on the training set of five test sequences." We agree with

appellants that "obtaining" the VLC code table means determining the length of the VLCs for the 290 entries in the code table, each entry corresponding to a predetermined pair of DMVs in Region A, not determining the most probable pairs to include in the VLC table. Thus, Yu does not anticipate claim 1.

Claim 7 recites "wherein training determines which x and y components to include in the entropy codebook." The examiner asserts that "these DMV pairs [in the VLC table] are determined through training runs." As previously discussed, Yu does not perform training runs to determine which DMV pairs to include in the codebook (VLC table)--Yu has predetermined that the DMV pairs in Region A, corresponding to the points in appellants' Appendix C, are the most probable pairs and will be in the codebook. Yu uses training only to determine lengths of VLCs for entries in the VLC table. Thus, Yu does not anticipate claim 7.

Claim 11 recites "wherein statistical analysis indicates which differential motion vector components to represent with variable length codes and which differential motion vector components to represent with an escape code followed by fixed length codes." The "variable length codes" are the codes that would be in a codebook or table. Claim 13 recites "wherein training determines which joint differential motion vector components to include in the table and which joint differential motion vector components to exclude from the table." Claims 16

and 20 both recite "wherein training determines which joint x and y motion vector components to represent in the set of available variable length codes." Claims 19 and 22 recite "wherein the Huffman table includes variable length codes for the most probable joint differential x and y components as computed by statistical analysis of example video sequences." All of these claims require training or statistical analysis to determine which DMV pairs to include in a table or to be represented as a VLC. Yu does not use training to determine which DMV pairs to be represented as a VLC in a table, but only uses training to determine the length of the VLCs for the pairs that have been already assigned to the table. Yu does not anticipate claims 11, 13, 16, 19, 20, or 22.

In summary, the rejections of claims 1, 3-13, and 15-22 are reversed.

REVERSED

KENNETH W. HAIRSTON)
Administrative Patent Judge)
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LEE E. BARRETT) BOARD OF PATENT
Administrative Patent Judge) APPEALS
) AND
) INTERFERENCES
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